Programmable Relaxor Open-Loop Mirrors Using Imaging Spatial Encoder (PROMISE), Phase I

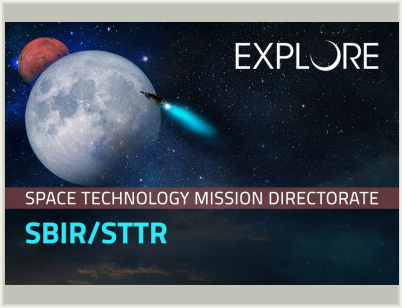
Completed Technology Project (2007 - 2007)

Project Introduction

Future advanced telescopes require active mirror compensation without the complexity of real-time adaptive control. Current wavefront correctors, while dimensionally stable, require closed loop control using a wavefront sensor and complicated electronics to maintain mirror shape. For space based systems, simplified open loop control is desirable since it reduces power and weight while greatly improving system reliability by reducing complexity and electronic parts count. Xinetics proposes a Programmable Relaxor Open-Loop Mirror using Integrated Spatial Encoders (PROMISE) that combines surface parallel actuation and micro optical encoders. The programmable relaxor open-loop mirror uses a surface parallel actuator array, made using ferroelectric micromachining originally developed for silicon based MEMS. The programmable actuator array enables the dimensionally stability and angstrom level control provided only by relaxor ferroelectrics, as has been demonstrated by the Jet Propulsion Laboratory. The integrated spatial encoder features an optical encoder that monitors dimensional change and is integrated directly between the actuator array and the surface mount interconnect. The voltage output of the optical encoder is used as a direct input to the feedback loop for the actuator circuit enabling electroactive control of the mirror surface without the necessity of an optical sensor, thereby enabling open loop control.

Anticipated Benefits

These types of mirrors hold great promise in extending adaptive optics to a wider community including amateur astronomers. Also, imaging, laser propagation, and laser control would all be able to use these mirrors, since they don't suffer from the MEMS limitation of little or no coating compatibility. Immediate application would be within the Airborne Laser program, where weight and control are critical. Solid state laser development could use these mirrors inside the resonator cavity with great success. Also, commercial applications in the ophthalmic market already are beginning to use deformable mirrors to aid in research into the properties of the human eye.



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Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Center / Facility:

Jet Propulsion Laboratory (JPL)

Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

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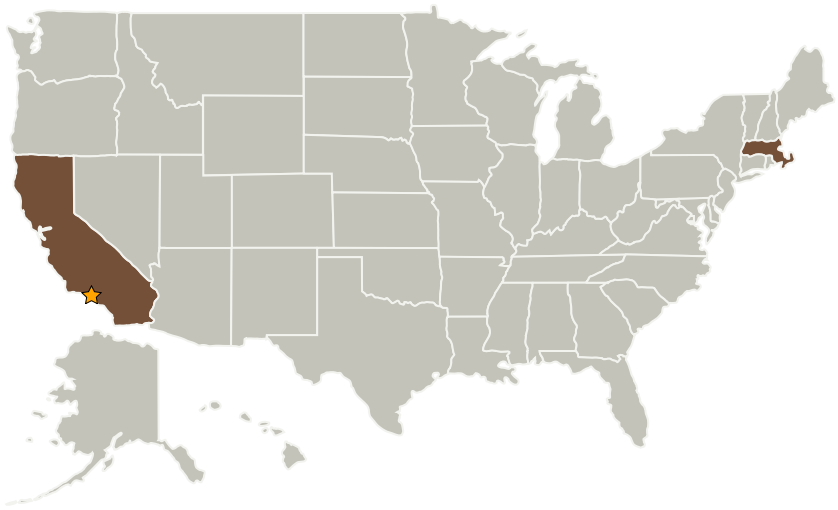
Primary U.S. Work Locations and Key Partners



Organizations Performing Work	Role	Type	Location
★Jet Propulsion Laboratory(JPL)	Lead Organization	NASA Center	Pasadena, California
Xinetics, Inc.	Supporting Organization	Industry	Devens, Massachusetts

Primary U.S. Work Locations	
California	Massachusetts

Project Management

Program Director:
Jason L Kessler

Program Manager:
Carlos Torrez

Project Manager:
Celestino Jun Rosca

Principal Investigator:
Shoko Yoshikawa

Technology Areas

Primary:

- TX08 Sensors and Instruments
  - TX08.2 Observatories
    - TX08.2.1 Mirror Systems